

## Opportunity

## Approach

Additional goals for the new energy strategy included assessing Romania's comparative advantages with regard to the availability and use of energy resources (both domestic and imported) and the environmental impacts associated with different fuel policy options.

The integrated modeling framework was configured so that the pros and cons of alternative economic and energy strategies could be measured in terms of their ability to achieve the overall goals and objectives of the country, while satisfying the pollution control requirements. More specifically, the



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    SDA[Supply, Demand, and Technology Assumptions] --> Scenario[Scenario]
    Scenario -- "Macroeconomic Assumptions" --> MM[Macroeconomic Model]
    Scenario -- "Technology Assumptions, Energy Efficiency, Fuel Prices, Energy Substitution" --> ENPEP_MAED[ENPEP MAED Module]
    Scenario -- "Build Strategy" --> ENPEP_ELECTRIC[ENPEP ELECTRIC Module]
    
    MM -- "Sectoral GDP, Population, Income" --> ENPEP_MAED
    ENPEP_MAED -- "Annual and Hourly Electricity Demand" --> ENPEP_ELECTRIC
    ENPEP_MAED -- "Hourly Loads" --> PSM[Peak Shave Model]
    PSM -- "Shaved Loads" --> ENPEP_BALANCE[ENPEP BALANCE Module]
    PSM -- "Hydro Capacity and Energy" --> HM[Hydro Model]
    HM -- "Hydro Capacity and Energy" --> ENPEP_ELECTRIC
    
    SDA -- "Energy Policy" --> ENPEP_BALANCE
    MM -- "Sectoral Energy Demand" --> ENPEP_BALANCE
    MM -- "Energy Demand Growth" --> ENPEP_BALANCE
    
    ENPEP_BALANCE -- "Build Schedule" --> ENPEP_ELECTRIC
    ENPEP_BALANCE -- "Fuel Cost" --> ENPEP_ELECTRIC
    
    ENPEP_ELECTRIC -- "Cogeneration Forecast" --> CHA[Cogeneration and Heat Analysis]
    CHA -- "Heat Demand" --> ENPEP_BALANCE
    CHA -- "Operation of Generating Units" --> ENPEP_IMPACTS[ENPEP IMPACTS Module]
    
    ENPEP_BALANCE -- "Energy Flows" --> ENPEP_IMPACTS
    ER[Environmental Regulations] -- "Check Compliance" --> ENPEP_IMPACTS
  
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configuration helped analysts to identify policies that would promote the development of a system that aligns the future economic structure of the country with its energy resources. The modeling system achieved this goal by simulating market forces via price signals, so that energy supply resources and demands are in equilibrium. The primary computer tool used in the analysis was the Argonne-developed ENergy and Power Evaluation Program (ENPEP). Four ENPEP modules (MAED, BALANCE, ELECTRIC, and IMPACTS) were at the core of the analysis. Other modeling tools – developed by Argonne and Romanian energy experts – were used in combination with these ENPEP modules.

## Scope of Work

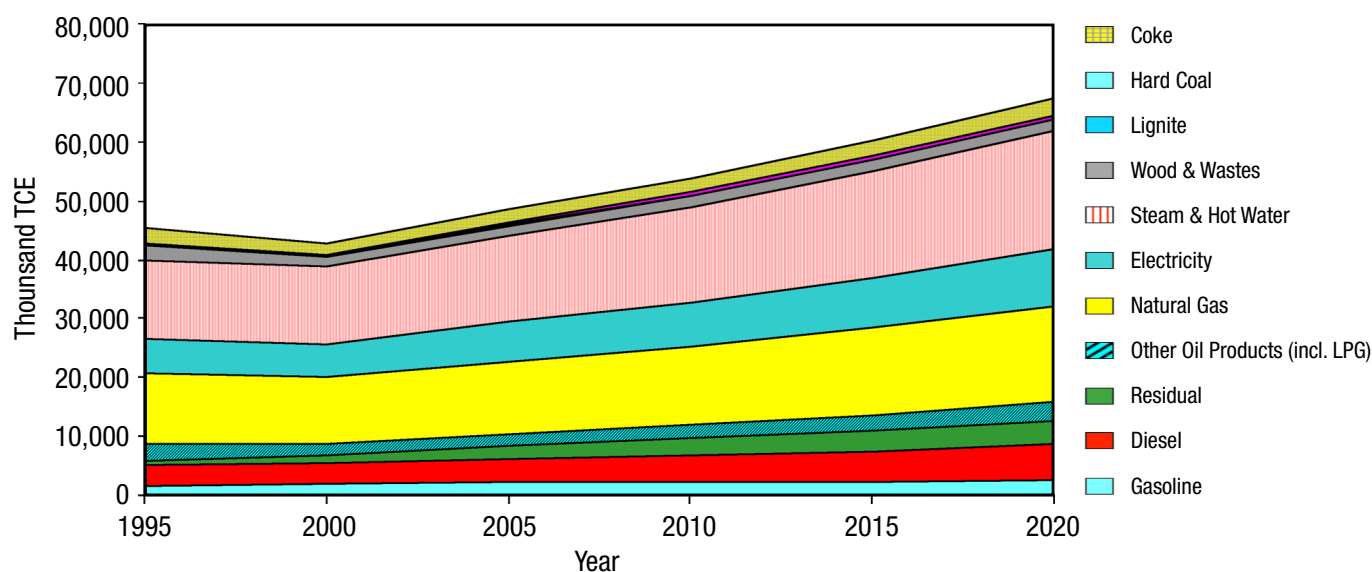
The links among energy supply and demand, energy prices, and economic activity in Romania are complex and involve a high degree of uncertainty. For this reason, the long-term energy supply options and the evolution of energy balance up to 2020 were analyzed. Several scenarios were analyzed to take into account different assumptions regarding the possible future development of the energy sector and the overall Romanian economy.

The key assumptions used to create the scenarios were related to the macroeconomic projections, diversification of imported energy sources, rehabilitation and modernization of the energy sector, restructuring of the industrial sector, development of nonutility and independent power producers, removal of subsidies, projections of fuel prices, and fuel switching and substitution. Seven alternatives plus a reference case were analyzed in detail.

## Results

The study provided recommendations for a sustainable energy policy in Romania: liberalizing the domestic energy market, improving technology efficiency, conserving energy, increasing the use of renewable energy resources, implementing strict pollution controls, improving energy management, diversifying energy supply sources, establishing adequate domestic fuel stocks, increasing research and development, and implementing advanced energy technologies. The analysis performed by Argonne and Romanian experts served as a basis for the long-term energy strategy adopted by the Government of Romania.

### Final Energy Demand by Energy Form



Learn more about the Center for Energy, Environmental & Economic Systems Analysis at:  
<http://www.dis.anl.gov/ceesa>

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